Effective & Sustainable Integrated Land Use Planning; A case study from the Okavango

Introduction

The Southern Africa Regional Environmental Program (SAREP) received requests from OKACOM member countries to provide sub-basin level planning to update land allocation workflows and planning frameworks. The Tawana Land Board identified the Seronga Sub Land Board planning area for a pilot activity to apply the Land Use Conflict Identification Strategy (LUCIS) as a means to update land allocation workflows. Land allocation as currently practiced, is identified in the Okavango Delta Ramsar Site Strategic Environmental Assessment (SEA) as having a potential to break-up habitat connectivity possibly leading to a major change in the overall character of the Okavango Delta as a functioning wetland system.

LUCIS was developed through the University of Florida by Margaret Carr and Paul Zwick and has subsequently been adapted to a number of different planning scenarios. LUCIS is based on the work in Eugene P. Odum's *Strategy of Ecosystem Development* (1969).

LUCIS can be described in Five Steps:

1. Use ***expert input*** to define conservation, agriculture and development ***policy goals and objectives*** to use as criteria to determine suitability for allocating land to different land-use categories;
2. Inventory and ***assess potential data*** relevant to each policy goal and objective
3. Analyze data to ***determine relative suitability*** for each policy goal
4. Present combined suitabilities for each goal to ***obtain stakeholder preference*** for the three major land-use categories
5. Compare the three land-use preference to clearly present the source of likely areas of ***potential future land-use conflict***

The five steps were completed with assistance from the main Tawana Land Board guided by the Seronga Sub Land Board. Key to subsequent implementation of the outputs from this pilot is *stakeholder understanding and inclusion in the planning process*. To achieve this, the main and sub District Land Use Planning Units (DLUPU) were included in the introductory and subsequent model development meetings. Their inclusion provided district level expert input from all main government departments involved in land use, resource utilization and conservation at the district level.

Map 1: Seronga Sub Land Board as a Fenced and Resource Bounded Planning Area

The Background

With current land use practices, the Okavango Delta is predicted to change to an alternate state in less than ten years. Whether that change yields positive or negative benefits for the majority of stakeholders is partially dependent on future land allocation under the Department of Lands through the main and sub land boards in Ngamiland.

The approach adopted by SAREP and being implemented with the Tawana Land Board is not simply the development of another land use plan, for which there are already many. Rather it is an iterative process that utilizes computer models to assist decision makers linked across landscapes from the community to national policy makers with land allocation and subsequent land and environmental management. The level of detail is much greater than current district and environmental management plans accounting for each 0.25 hectare of the entire planning area providing opportunities to allocate land for multiple uses across the landscape.

The models outlined are designed to avoid the potential for future land use conflict. They are the result of expert input and stakeholder preference, which was derived from meetings with all of the communities in the Seronga Pilot study area and all relevant government stakeholder. The models developed through this process are not cast in stone and may be adjusted based on feedback and experience during implementation. The models of land suitability reflect current national policy and can assist in monitoring policy impact and guiding policy adaptation.

Previous district land use plans proposed zoning at a very coarse scale which provided an opportunity for policy related land use conflict to develop. The approach taken by SAREP utilized computer models to generate three general landscapes representing agriculture, developed and conservation at a much finer scale, allowing the land board to assign different suitability values to individual 250 metre square grid cells. Community meetings were held to determine stakeholder preference for the proposed suitability factors. The resulting three landscapes broadly incorporate different government departmental policy which when overlaid can identify potential future land use conflict. Potential future conflict can be resolved through allocation to the proposed different land use zones or policy review.

One of the core objectives of the approach was to integrate stakeholders from different sectors into the development of the land use models, so that sector based objectives were supported and that there could be transparency between sectors on how they wanted to achieve these various objectives. Crucial to this process was also the integration of community opinions and desires, so that they were also able to take ownership of the process. To ensure that National level priorities and objectives were also incorporated a review of all relevant Policy was undertaken, and where land use components were identified integrated into the model. Of specific importance were recommendations from the Okavango Delta Ramsar Site's SEA.

The ODRS SEA was developed using a resilience planning framework that stresses the linkages across landscapes, scales and time. The SEA focused on the District or Sub-basin scale and suggests a ten year time frame. This implementation guideline addresses the sub-district scale and will directly impact individuals at the community scale who expect more immediate results to address their livelihood needs. Resilience thinking emphasizes the activities at one scale are influenced by and influence the scale above and below the focal planning level.

An approach incorporating a scenario matrix which identifies positive and negative alternate potential futures is utilized to incorporate environmental considerations into land allocation and subsequent management that explicitly recognizes the potential for change to an alternate state within ten years. Likelihood of a positive or negative future depends on the land authority monitoring the proposed targets associated the zones or not limiting future land allocation based on the targets associated with a proposed zone.

Implementation of LUCIS in Seronga

Step 1

A preliminary model of the three components of land use developed with district level expert input is the output from step one in the five steps of the LUCIS development approach. Step two focuses on the inventory and assessment of data for each of the three components in order to develop land use suitability rankings in the third step. It's important to note, that only existing data has been used. The model will improve over time if new data is acquired and made available. Many of the LUCIS model inputs are derived from commonly available data such as roads to determine access and water sources to determine availability. Therefore *availability of data does not have to be a limiting factor to using the LUCIS approach*.

For the conservation, agriculture and development components, four datasets emerged as critical from the experts input. Of these, data to determine suitable sites for burrow pit location and village boundaries to determine settlement expansion were not available for inclusion in the development component. Proxies (distance and location from village) or alternative means (cleared areas from imagery) have been used for model inputs.

The power of the LUCIS to contribute to conflict resolution emerged through the recognition and willingness of interested stakeholders to contribute their data or input to the model. For the conservation component, wildlife movement pathways and analysis of the likelihood of field invasion identified from research by the NGO EcoExist, provided the basis for the proposal of corridors to maintain access to water and connectivity of habitats.

Subsequent preference determination highlighted the importance of suitable soils for identification of agriculture areas. Existing data was assessed and reclassified to the LUCIS format with input from the District and National Offices of the Department of Crop Production. A key element of this step in the LUCIS process is the assessment of the data for suitability mapping. Visual assessment of the soils data noted a discrepancy between the hard copy and digital data that was checked and confirmed by Department of Crop Production to ensure the results presented were valid.

Step 2

Inventory and assessment of data for the three components of land use developed with district level expert input, is the output from step two in the five steps of the LUCIS development approach.

Step 3

In the third step, the data relating to policy goals is analyzed to determine relative suitability and visualized separately as model components. It should be noted that training in the use of LUCIS focusing on the software or technology was provided to government departments, but little traction in actual application of the LUCIS models was realized.

Only when LUCIS map components were combined to visualize current or future conflict, did it become clear that the adoption of LUCIS is more clearly understood when it is applied in the context of immediate land use issues. Furthermore, the *process* of developing the inputs with stakeholders appears to be more critical to understanding, than the technology used to produce the maps.

Follow-up meetings were held with the same group of experts representing government departments at the district level. During this meeting the inputs for the model were presented in tabular form and displayed as maps for the agriculture, conservation and development components.

After the presentation, the component groups broke out and reviewed their initial inputs as they now appeared on the maps. Two of the three groups addressed the modeller over apparent changes from their inputs in the initial planning session, indicating their model had been changed. Although one change was an error in datasheet interpretation and the other was a misunderstanding of intent, it was clear that the stakeholders had taken ownership of the process and of their own criteria identification and rankings as an outcome of these sessions, there was therefore not only a general understanding of the process, but of specific inputs.

Map 2: Areas Near Settlements Suitable for Arable Agriculture

In addition to presentations to the expert groups, the land board organized a session for all sub land board members to attend a presentation of the LUCIS model and its current status with the preliminary suitability maps. This session further grounded the LUCIS application in the realities facing the land board with its current land allocation process and the need to update land allocation workflows to incorporate wildlife movement corridors.

Step 4

Suitability maps updated with expert group feedback for the three components of land use are the output from step four in the five steps of the LUCIS development approach. The updated suitability maps agreed upon during the third step, were taken to a series of ten village meetings organized by the sub land board. A half day was allowed for each meeting.

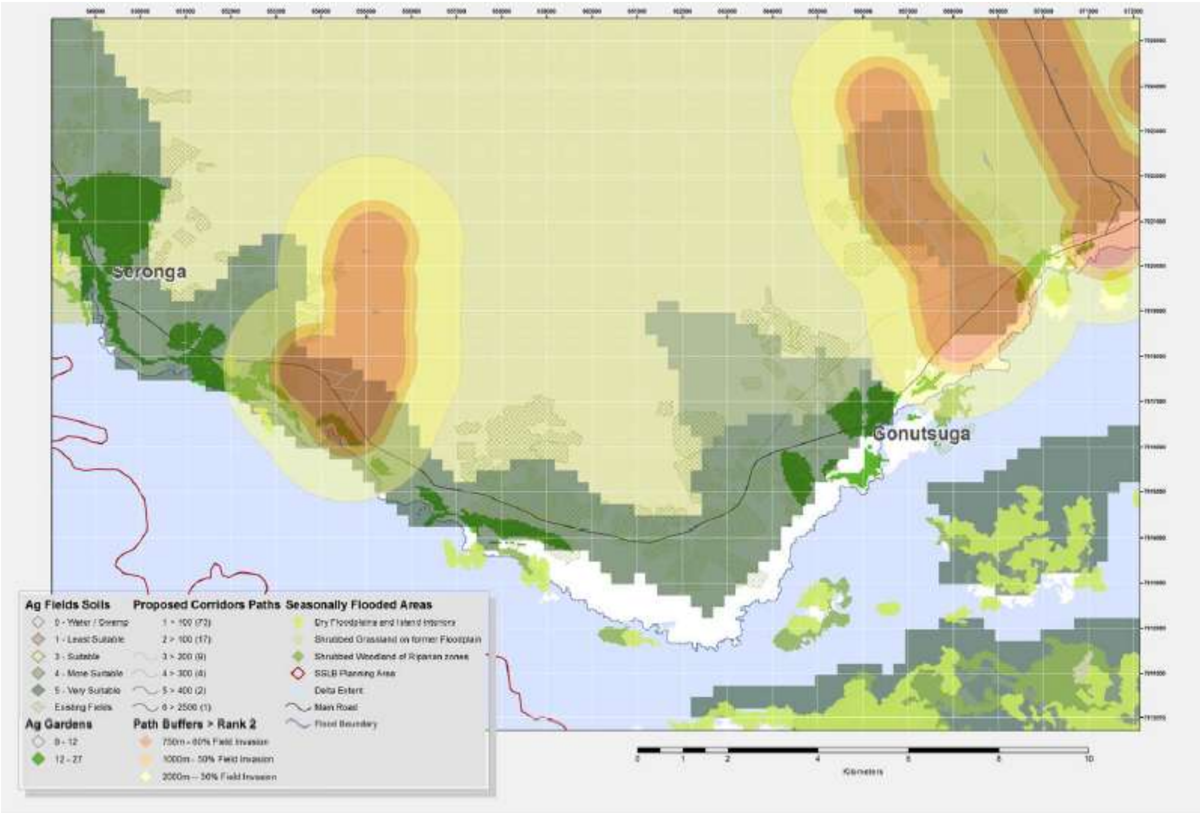
The LUCIS process makes a distinction between suitability and preference. Suitability is determined by asking how suitable a piece of land is for a particular agriculture, conservation or development use. Preference seeks to determine which of the suitability criteria used are most important. A distinction is also made between the expert group, who provides input about suitability and the stakeholders, most likely to be impacted by the decisions of the experts, who are given a chance to show their preference for the different suitability criteria.

LUCIS preference mapping has been described using software running an analytical hierarchy process (AHP). A trial of this approach was conducted with the expert group who determined a much simpler approach will be necessary to determine stakeholder preference at the community level. Previous success was noted with a voting process which in this case was used to rank and determine the preference for the different suitability factors that had been used to develop the maps.

It is ***important to note that the planning area is unique not only to northern Botswana or Botswana as a whole, but the entire region***. The ratio of human / livestock / wildlife in a bounded space is highest for wildlife. The wildlife population is growing faster than the other two. The impact of this was evident in the meetings and confirmed the need to consider the proposal of wildlife movement pathways using updated land allocation guidelines. The community meetings were conducted with village leadership often in three different languages through the assistance of facilitators.

Although probably not to the highest scientific standards, it is clear the communities have specific preferences for the suitability factors presented and were able to engage in dialog over the distances proposed for the model. One farmer, obviously adversely affected by field invasions from livestock, suggested livestock should be kept 10 kilometres from the village, essentially in the next village.

Consistent across all meetings was stakeholder input for an alternate land use scenario that includes gardens near settlements for household use, possibly as an alternate to increasing loss of arable fields to wildlife movement pathways. This scenario has subsequently been incorporated into suitability maps for the agriculture component with updated workflows for their allocation.



Map: 2: Proposed Subsistence Use for Gardens in Flood Plains

<u>Step 5</u>

The relative preference for each land use type and subsequent ‘draft zones for allocation’ was the output from step 5. The suitability maps presented to the communities and Government stakeholders were revised based upon the feedback received. The revised suitability maps were then combined to ascertain where areas of conflict for future land allocations occur.

Revised suitability maps took cognisance of community preferences for landuse and the factors associated with each land use type, for example, when communities were asked what factors / criteria were important to <u>them</u> when they looked for a ploughing field the results highlighted the importance of fertile soils, the distance to the village, the location of their existing fields, access to surface water and then with less significance the distance to the road and elephant pathways. Subsequent community meetings were then held to resolve issues of land use conflict, where areas defined as suitable for ploughing fields overlapped with, for example, elephant pathways and village growth areas. Each conflict type was discussed at another series of community meetings, to resolve and define relative land use preferences.

The results were such that there should be no allocation within defined wildlife corridors, whilst the identification of good soils with future village expansion areas should be allocated to ploughing fields, with village growth to be non-uniform. The acceptance and desire of communities to secure land for wildlife corridors should result in the reduction of future human-wildlife conflicts, so that ploughing fields and gardens are allocated in clusters on good soils outside of corridors. Clustered fields will provide additional protection to individual fields and lowering the collective cost and man power required to adequately fence them from elephants. Allocation of arable agriculture onto conflict free areas with high soil fertility, should lead to improve yields and a subsequent improvement to people’s livelihoods.

Summary of objectives and Results

Objectives / Challenges

- Incorporate environmental concerns into updated land allocation workflows
- Overcoming land use conflict resulting from sector driven policy development and implementation
- Address the concern over loss of habitat and connectivity from land allocation in the ODRS
- Address the scale of planning zones and resolution (size) of planning units in current regional and district land use plans

Solution

- ***Promote and organize inclusive expert inputs*** in development of an integrated model reflecting conservation, agriculture and development land use categories
- ***Recognize the need to update land allocation workflows*** and inputs reflecting the need for corridors to maintain connectivity between habitats supporting wetland system functions
- ***Utilize stakeholder input*** in computer generated models to assign specific land use categories to finer resolution (250m^2) planning units that provide more allocation options than previous broad brush categories

Results

- ***Expert input obtained*** from planning meeting attended by Sub-District Landboard Chairmen, Land Use Officers and main and sub District Land Use Planning Units (DLUPU)
- Overview and **general understanding of model approach** and need to incorporate findings from ODRS SEA to address **concerns over irreversible change to the ODRS Preliminary model developed** and data sources identified for conservation, agriculture and development components to be assessed in the second step of the LUCIS model development
- An unplanned for result includes the development of a **framework for linked multilevel decision making**, from the sub-district up to the sub-basin. Subsequent input from the sub land board included linkages down to the community level providing, providing an opportunity for **resilience planning** as outlined in the Strategic Environmental Assessment